

REMARKS

Applicant has carefully reviewed and considered the Office Action mailed on September 16, 1999, and the references cited therein.

Claims 33 and 57 are amended, as a result, claims 1-85 are now pending in this application.

*Rejection of Claims as being Based Upon a Defective
Reissue Declaration Under 35 U.S.C. 251*

Claims 1-85 were rejected as being based upon a defective reissue declaration. As noted above, a corrected and signed reissue declaration is submitted herewith. Claims 1-85 are believed to be in condition for allowance.

§112 Rejection of Claims

Claims 33 and 57 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 33 and 57 are amended to overcome this rejection, and are now believed to be in condition for allowance, and such action is respectfully requested.

§103 Rejection of Claims

Claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 were rejected under 35 U.S.C. 103(a) as being unpatentable over Shigeyama et al. (5,450,204) in view of Halioua et al. (4,641,972). Applicant respectfully traverses the rejection. Applicant submits that, contrary to the assertion of the Examiner, Shigeyama et al. does not "maintain[] the projected pattern of light and the detector in a substantially fixed relation to each other," but instead used the LCD pattern generator to sequentially move the projected pattern of light (see Figures 5A-5D). This merely replaces a moving physical pattern grating in the projector with an electronically controlled LCD having moving patterns. Further, Shigeyama et al. does not "mov[e] the object relative to the projected pattern of light so as to scan the projected pattern of light across a surface of the object to generate an imagable light signal," but rather remains at a fixed location while it uses the LCD to scan the pattern, and then moves the circuit

board to another fixed location to again scan using the moving pattern generated by the LCD. The Examiner admits that Shigeyama et al. does not teach "the detector having a first, a second, and a third detector element, wherein the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light."

Applicant submits that, contrary to the assertion of the Examiner, Halioua et al. does not provide such a teaching. Rather, Halioua et al. again provides a moving or scanned sinusoidal phase pattern, and with any particular detector (e.g., D_c of FIG. 7), records three images of a point D of the object with a phase increment of 120 degrees following each recording. This is apparent even from the sections cited in the Office Action column 4 lines 10-13 and column 4 line 62-column 5 line 4:

" A_n is one of the detectors in the array, located at the image plane and is used to measure the intensity at C on the reference plane and at D on the object. "

"By recording N frames of intensity data, the phase seen by each detector in the array can be computed, both for the reference plane and the object surface. Based on the continuity of the phase function, starting from a reference location with zero phase, the integer M of Eq. (6) can also be determined by monitoring the computed phases between two adjacent detectors and identifying sharp phase discontinuities which result from the 2π transitions. "

See also column 7 lines 20-33 and column 8 lines 26-28:

" Surface profile measurements were made, using the system of FIGS. 1, 2, on a general test object (a half cylinder with two sections having different radii), mounted on a reference plane and illuminated with a sinusoidally varying beam intensity as previously described. In order to generate a phase variation in both the horizontal as well as vertical directions an inclined set of fringes were projected on the object. FIG. 5 shows the deformed grating as seen by the detector array. Three images each were recorded for the reference plane and the object surface, with a phase increment of 120° of the projected fringe pattern following each recording, and processing was performed as previously described."

" A particular detector such as D_c can measure the phase ϕ_c at a point C on the reference plane as well as ϕ_D on the point D of the object."

Thus, neither reference provides the limitations that the Office Action asserts that they do and they do not render the claimed invention obvious, and thus claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 appear to be in condition for allowance, and such action is respectfully requested.

Regarding claims 39-41, 52-54, 69-71 and 82-84, the Examiner asserts that it would have been obvious to one of skill in the art to add a second projected pattern of light. The Examiner asserts a rationale that using an extra projected light would provide better performance. Applicant respectfully traverses the rejection and its unsupported rationale. The Examiner has the burden under 35 U.S.C. § 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). To do that, the Examiner must show that some objective teaching in the prior art or some knowledge generally available to one of ordinary skill in the art would lead an individual to combine the relevant teaching of the references. *Id.* Further, the Examiner must avoid hindsight and must not use the teaching of the application as a template to reconstruct the invention.

Request under MPEP 2144.03

If the Examiner submits that it is well known in the art that using an extra projected light would provide better performance, and it would have been, therefore, obvious to add an extra projected light, or to alternately project one or the other light patterns, then Applicant respectfully traverses this assertion of official notice, and under MPEP 2144.03, respectfully request the Examiner cite a reference in support of his position.

Applicant submits that the Examiner has failed his burden to establish a *prima facie* case of obviousness at the time of the invention of any of the limitations of claims 39-41, 52-54, 69-71 and 82-84, and that these claims appear to be in condition for allowance.

Claims 31, 34, 37, 43, 47, 79-51, 59, 61, 63, 67-68, 73, 77, 79-81 were rejected under 35 U.S.C. 103(a) as being unpatentable over Shigeyama et al. and Halioua et al. as applied to claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 above, and further in view of PRIOR ART. Applicant respectfully traverses the rejection. As described above, those various base claims appear to be allowable over Shigeyama et al. and Halioua et al. as applied to those claims, and as described above, Shigeyama et al. and Halioua et al. do not apply to corresponding limitations of claims 31, 34, 37, 43, 47, 79-51, 59, 61, 63, 67-68, 73, 77, and 79-81. PRIOR ART is a trilinear array camera 24, for example, the Kodak CCD chip model KLI-2103 which has 3 rows of detector or sensing elements 25 each having 2098 CCD sensing elements per row. Examiner admits that Shigeyama et al. and Halioua et al. do not teach a tri-

linear array. Examiner asserts a rationale that such trilinear camera would detect first second and third phase simultaneously and therefore speed measurements.

Applicant respectfully disagrees. Both Shigeyama et al. and Halioua et al. scan the projected phases but keep the camera and object fixed (not moving) relative to one another while obtaining the different phase measurements. Each uses an array detector, with each pixel receiving an image from a single area of the object being measured. At successive times, successive images are recorded, each at a different phase due to the scanning of the phase pattern between image times. One each of these successive recorded phase images, the same area is imaged to the same pixel, however each at a different phase of the scanned pattern. Were one to replace the imaging devices of Shigeyama et al. and Halioua et al. with a trilinear array, one would obtain only successive trilinear images of three stripes of the object, rather than the entire object (each of the three imager stripes receives a different stripe of the object, rather than simultaneously receiving three phase measurements of a single stripe of the object as the Examiner asserts).

In contrast, the present invention teaches that by scanning the camera relative to the object, at a first point in time, the first line of the detector measures a stripe of the object at a first phase of the projected light (while the second and third lines of the detector measure other stripes of the object), at a second point in time, the second line of the detector measures the same stripe of the object at a second phase of the projected light (while the first and third lines of the detector measure other stripes of the object), and at a third point in time, the third line of the detector measures a stripe of the object at a third phase of the projected light (while the first and second lines of the detector measure other stripes of the object). Thus, over three points in time, the trilinear array measures three lines, each at three phases, averaging three phases for one line per time. This is not obvious from any of the references nor from the Examiners arguments. Thus, claims 31, 34, 37, 43, 47, 79-51, 59, 61, 63, 67-68, 73, 77, 79-81 appear to be in condition for allowance, and such action is respectfully requested

AMENDMENT AND RESPONSE

Serial Number: 09/111,978

Filing Date: July 8, 1998

Title: SCANNING PHASE MEASURING METHOD AND SYSTEM FOR AN OBJECT AT A VISION STATION

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Dkt: 139.045USR

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612-373-6949) to facilitate prosecution of this application.

If necessary please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Assistant Commissioner of Patents, Washington, D.C. 20231 on January 18, 2000.

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